

Environmental Research Aircraft and Sensor Technology

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The Environmental Research Aircraft and Sensor Technology (ERAST) Program provides focus for critical technology development and flight demonstration that reduce the technical and economic risk of using remotely piloted aircraft (RPA) as a means of collecting scientific data in a timely and cost-effective manner. The ERAST Sensor and Science Mission Element provides focus for sensor (science and platform) and mission development and demonstration.

Fiscal Year 1997 saw the completion of a 3-year development program designed to provide the Atmospheric Effects of Aviation Program and the Upper Atmosphere Research Program with a new generation of small, lightweight, low-power RPA-class sensor systems. Although the development of high-altitude RPAs has been beset by many problems, the following ERAST-developed sensors have provided valuable contributions in 1997: STRAT (Stratospheric Tracers of Atmospheric Transport), POLARIS (Photochemistry of Ozone Loss in the Arctic Region in Summer), OMS (Observation from the Middle Stratosphere), ACE 2 (Second Aerosol Characterization Experiment), and Pathfinder science campaigns worldwide. New surface acoustic-wave sensor technologies were explored that have the potential to significantly reduce the size of instruments designed to make in situ measurements of trace gases in the low-pressure atmospheres.

Technologies for over-the-horizon (OTH) communications, which are key to extending the range of RPAs beyond line-of-sight telemetry, were explored and developed in 1997. Preparations for a trans-Pacific flight of the General Atomics Altus RPA were developed to evolve, test, and assess the policies and procedures for operating these unique aircraft in national airspace. Development priorities of Altus shifted focus to demonstrating new payload and satellite-communication technologies on the surrogate RPA testbed platform (Piper Navajo aircraft). The system, built on the Tracking and Data Relay Satellite System Surface Movement Advisor demonstrated in 1996, complemented with a mechanically steered

planer-array high-gain antenna, provided continuous cockpit teletype communications, interactive operation on remote-sensing experiments (sea surface temperature measurements), real-time status and command of platform and experiment, and web-based monitoring of experiment location and status. The new antenna allowed higher bandwidth (38.8 kilobytes-per-second data), in a smaller, lower-weight, lower-power OTH communications package.

The Ames-managed ERAST element deployed the first Mission to Planet Earth RPA science mission in 1997. The ERAST-funded, Ames-developed digital array scanned interferometer (DASI) and Airborne Real-Time Imaging System (ARTIS) were integrated on the Solar Electric Pathfinder at the ERAST RPA flight-test facility at the Pacific Missile Range Facility on Kauai, Hawaii. The DASI instrument system, developed to provide an interferogram for each pixel in the pushbroom scanner, operates interactively via the internet. The ARTIS color infrared 6-megapixel digital camera system provides near real-time imagery on the web with interactive control. Integration, testing, and operation of both imagers on this unique platform required extensive collaboration between RPA operators and the science investigators to develop new safe, efficient, and flexible procedures to exploit the advantages of these exciting new systems. Pathfinder set an altitude record of 71,530 feet in July 1997. Integration was accomplished in August and September.

The science and sensor element of ERAST endeavors to reduce obstacles to the emergence of a new aerospace market developed around remotely piloted aircraft by driving new regulatory and operational procedures, developing operational experience, and expanding applications.

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